MoDSS – a compact Mobile Decay Spectroscopy Set-up for the investigation of heavy and superheavy nuclei after separation

D. Ackermann[*1], *F.P. Heßberger*[1,2], *J. Hoffmann*[1], *N. Kurz*[1], *J. Maurer*[1], *A.K. Mistry*[2], *J. Piot*[3], *M. Vostinar*[3], *and P. Wieczorek*[1]

[1]GSI, Darmstadt, Germany; [2]HIM, Mainz, Germany; [3]GANIL, Caen, France

The investigation of the nuclear structure of heavy and superheavy nuclei [1] relies on the performance of advanced comprehensive charged particle and photon detector set-ups, mounted close to the target position for in-beam detection or designed for decay spectroscopy after an ion optical separator, like e.g. the focal plane detector set-up TASISpec [2].

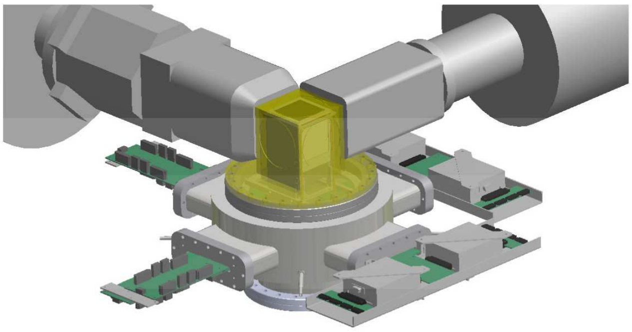

Figure 1: Schematic view of the detector configuration consisting of the aluminum housing of the Si-array surrounded by large volume Ge-detectors (two of five possible are shown here) and the chamber accommodating the two types of complementary electronics.

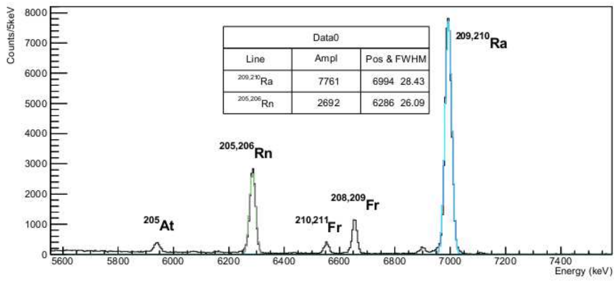

Figure 2: First α spectrum obtained at a test run at the velocity filter of the LISE spectrometer at GANIL using analog signal processing.

troscopy Set-up (MoDSS) for the detection of heavy ion reaction products and its decay radiation and its first test at the LISE setup of GANIL [3], employing the reaction ^{40}Ar+^{174}Yb$\rightarrow$^{214}Ra*. It consists of a combination a 60$\times$60 double sided silicon strip detector (DSSD) with an active area of 60$\times$60 mm^2 of 300 μm thickness, surrounded in its backward hemisphere by four single sided silicon strip detectors (SSSD) of the same dimensions subdivided into 32 strips, forming a cube with one open face upstream for accepting the incoming particles. The array is housed in a compact chamber with thin aluminum windows (1.5 mm) facing the backside of all five detector chips to allow for the detection of γ-rays emitted by the reaction products implanted in the DSSD. In Fig. 1 a schematic view of the set-up is shown together with the chamber, housing the two types of front end electronics employed for complementary signal processing.

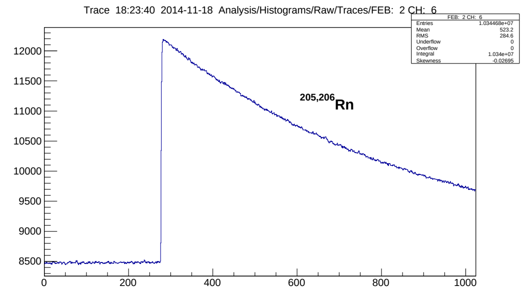

Figure 3: Example trace for an α decay pulse collected during the test run at the LISE velocity filter using the FEBEX [4] based digital MBS electronics.

For the front-end electronics there are two complementary options. An analogue data processing chain consists of a charge sensitive preamplifier (PA) developed by the electronics laboratory of the Nuclear Physics Department of the University of Cologne followed by Mesytec SMT16+ shaper and fed into an analogue data acquisition system (DAQ) on the basis of the GSI multi branch system (MBS). In Fig. 2 an α spectrum is shown, which had been obtained at the velocity filter of the LISE spectrometer at GANIL, Caen, France. At the end of this test run the second DAQ configuration was tested, using a set-up based on the flash ADC module FEBEX3A [4] developed in-house. An example trace taken with this configuration is shown in Fig. 3. As additional option the charge sensitive PA's can be substituted by the APFEL ASIC [5] in combination with the FEBEX DAQ, which provides a fast shaped pulse of 250 ns width and a two output signals for each input with amplification factors of 1 and 16/32 switchable.

References

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* d.ackermann@gsi.de

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